USGS

Sound Waves

Coastal Science and Research News from Across the USGS

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Fieldwork

USGS Instruments Record Turbidity Flows in Monterey Canyon, California

By Marinna Martini

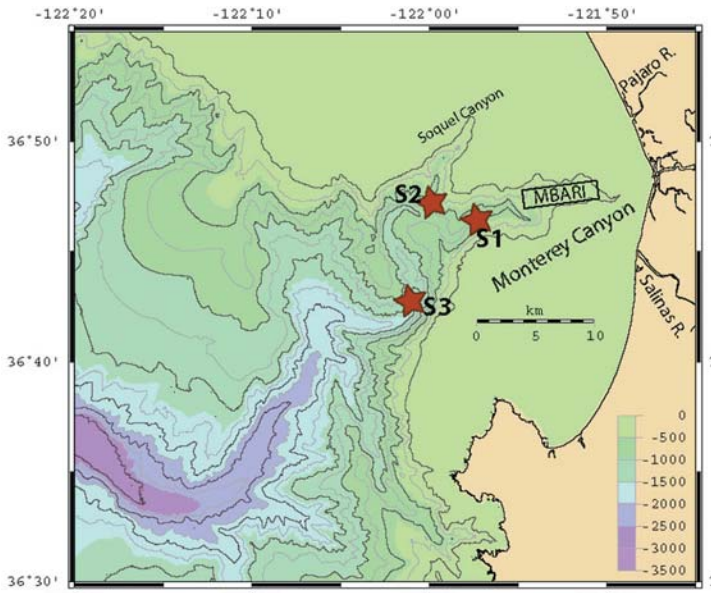
Monterey Canyon is known for its intermittent and dramatic downcanyon turbidity flows, or underwater avalanches of sediment and water. In 1994, tantalizing evidence of a turbidity flow was recorded by a U.S. Geological Survey (USGS) mooring in the canyon axis in 1,450 m of water. That event was violent enough to damage a pressure sensor and totally occlude an optical water-clarity sensor 100 m above the bed. Ever since, USGS researchers have been eager to get a better look at one of these elusive events. Last November, they got their wish when they recovered three moorings that had recorded flow-velocity profiles and collected sediment from four turbidity flows that tumbled down the canyon during the past year.

The moorings had been deployed in December 2002 as part of a joint effort between the USGS' Woods Hole Science Center, the Western Coastal and Marine Geology Team, and the Naval Postgraduate School in Monterey, CA. At 820-, 1,010-, and 1,450-m water depth along the canyon axis, the moorings were timed to be in the water simultaneously with instrumented bottom frames deployed by the Monterey Bay Aquarium Research Institute (MBARI) in shallower waters upcanyon.

Each USGS mooring was designed by **Marinna Martini** to suspend instrument packages above the bed at three or four heights specified by **Marlene Noble**, the project's chief scientist. Each package included an Anderson-type sediment trap, which collected sediment moving downcanyon and falling from the canyon walls,

(Monterey Canyon continued on page 2)

Jonathan Borden *(top) and* ***Steve Ruane*** *reach for the floats at the top of a mooring to start the recovery process. Standing by to assist are* ***Hal Williams*** *(third from top) and a crewman on the research vessel* Point Sur.



Monterey Canyon, CA, showing the location of USGS subsurface moorings deployed from December 2002 to November 2003 (S1, S2, and S3) and the area where MBARI deployed instrumented frames on the canyon floor during the same period (box labeled "MBARI").

Sound Waves

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Contents

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Deadline: The deadline for news items and publication lists for the April 2004 issue of *Sound Waves* is Wednesday, March 17.
Publications: When new publications or products are released, please notify the editor with a full reference and a bulleted summary or description.
Images: Please submit all images at publication size (column, 2-column, or page width). Resolution of 200 to 300 dpi (dots per inch) is best. Adobe Illustrator© files or EPS files work well with vector files (such as graphs or diagrams). TIFF and JPEG files work well with raster files (photographs or rasterized vector files).

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Fieldwork, continued

(Monterey Canyon continued from page 1)

and various sensors to measure temperature, salinity, current speed and direction, and suspended-sediment concentration. To keep the traps within 10 degrees of vertical and to avoid drag from the anticipated high-speed currents at the bottom, the moorings' design located all the flotation at the top. This design was risky: if too many of the glass flotation spheres imploded, or the mooring wire failed, only a specialized, deep-water remotely operated vehicle (ROV) might be able to find and recover the collapsed mooring.

Although they feared that the bottom of the moorings might be buried or battered by debris driven by turbidity flows, researchers were eager to get data and sediment close to the bottom. So, the bottom of each mooring was designed to be sacrificial: one acoustic release (which parts the wire when it receives an acoustic signal from the surface) was placed at the bottom of the mooring, below the lowermost instrument package, and another acoustic release about 60 m above the bottom. If the first acoustic release was buried and became inoperable, the second acoustic release could be activated, and all the instrumentation above the second acoustic release successfully retrieved. Thus, only the lowermost instrument package would be lost in the event of a large, damaging turbidity flow. If the lowermost instrument package could be retrieved intact, however, scientists would get data within 20 m of the seabed, where the greatest and most interesting sediment movement was believed to occur.

Jonathan Borden *drains seawater from a sediment trap to ease recovery. This trap was so full that sediment had to be cleared from the drain hole. Also visible are the transmissometer (mounted perpendicular to the trap), which measured suspended-sediment concentration, and a Seabird Seacat data logger (parallel to the trap), which recorded the transmissometer's signal, as well as seawater temperature and salinity.*

Also attached to each mooring was a downward-looking acoustic Doppler current profiler (ADCP), which uses sound waves and the Doppler effect to measure flow velocity at numerous points between the instrument and the sea floor. Each ADCP was attached just above the second acoustic release, about 60 m above the bottom, and measured flow-velocity profiles down to the seabed.

During the year that the moorings were in the canyon, reports came back from MBARI scientist **Charlie Paull** that MBARI's bottom frames were being pushed downcanyon by turbidity flows and battered by large, refrigerator-size rocks. The USGS team crossed their fingers and hoped that they would not see messages from the satellite beacons indicating that the moorings had parted and surfaced prematurely. After 11 months and 20 days of the 12-month deployment, **Steve Etchemendy** of MBARI reported that a string of floats had been sighted on the surface which looked suspiciously like the USGS' floats. So, 10 days before the planned recovery cruise, a gutsy team led by **Marla Stone** of the Naval Postgraduate School hopped aboard the research vessel *Shana Rae*, a 52-ft-long converted fishing boat, and spent 10 seasick hours in the dead of night recovering the 820-m-long mooring. Many hooks were found embedded in the mooring wire and instrumentation, suggesting that a fishing boat may have hooked into the mooring and parted the wire. However, the instrumentation had recorded the onset of a turbidity flow

(Monterey Canyon continued on page 3)

(Monterey Canyon continued from page 2)

at the same time the wire broke, and so debris in the turbidity flow may have been the cause. The wire broke near the bottom, thus everything was recovered except the sacrificial bottom instruments.

A week later, on November 25, 2003, a team from the USGS in Menlo Park, CA (**Marlene Noble**, **Jingping Xu**, **Joanne Ferreira**, **Hal Williams**, **Kevin Orzech**), the USGS office in Woods Hole, MA (**Marinna Martini**, **Jonathan Borden**, **Rick Rendigs**, **Steve Ruane**), and the Naval Postgraduate School (**Marla Stone**) recovered the rest of the moorings aboard the research vessel *Point Sur*. The team experienced only one more mishap, losing the sacrificial bottom part of a second mooring, at 1,010-m water depth, to an acoustic-release failure. Given the debris noted by MBARI, the release may have already been damaged, or its mechanical workings clogged. The third mooring, at 1,450-m water depth, was retrieved intact.

The data from all recovered instruments on the three moorings are currently being processed. Preliminary examinations showed some spectacular results. On all three moorings, the 1-m-long sediment traps at 64 and 158 m above the canyon bed were full of sediment—several traps were overflowing with it. The sediment layers in the traps (fine sediment overlain by coarse, then again by fine) clearly indicate an event-driven hydrodynamic

Closeup of sediment in the core barrels of sediment traps immediately after extraction from the traps on deck. Note the layering of sediment from different turbidity flows.

environment deep within the canyon. USGS scientists **Bill Normark**, **Brian Edwards**, **Homa Lee**, and **Kevin Orzech** and MBARI scientist **Charlie Paull** will help **Jingping Xu** decipher the information now buried in those cores, including analyzing them for contents of DDT and other pesticides, determining their stratigraphy, studying foraminifers, analyzing grain size, and measuring C^{14} isotopes and chlorophyll concentrations.

The downward-looking-ADCP profiles showed four distinct, violent turbidity flows during the year-long deployment: two in December 2002, a third in March 2003, and a fourth in November 2003. The December 2002 and March 2003 events had measured current speeds of more than 1.5 knots near the bed; the highest current speed recorded during the second event was nearly 4 knots. That second event (on Dec. 20, 2002) moved the shallow USGS mooring at 820-m water depth almost a third of a mile downcanyon and may have moved and covered the MBARI moorings deployed in shallower waters in the canyon axis. The USGS moorings at 1,010- and 1,450-m water depth stayed in place during these strong events.

A preliminary look suggests that the USGS moorings will provide detailed turbidity-flow data never before recovered from a submarine canyon. In addition to shedding light on the flows themselves, the data set will allow examination of possible triggering mechanisms, which include not only earthquakes, surface waves, and density flows but also the large, near-bottom internal tides that **Marlene Noble** and **Leslie Rosenfeld** (Naval Postgraduate School) already noticed in the current-meter records.

The entire Monterey Canyon team is waiting breathlessly to see the final processed data from all the recovered instruments. ❁

Mapping National Parks on the Big Island of Hawai'i

By Susie Cochran-Marquez

The U.S. Geological Survey (USGS) has recently contracted with the National Park Service to help create an inventory of geologic resources for three parks on the west coast of the Big Island of Hawai'i. In December 2003, a team of scientists from the USGS' Pacific Science Center in Santa Cruz, CA (**Susie Cochran-Marquez**, **Ann Gibbs**, **Eric Grossman**, and **Josh Logan**), visited Kaloko-Honokohau National Historical Park, just north of Kona, to collect underwater video footage for use in interpreting existing remotely sensed images. Building on previously ac-

(Hawai'i continued on page 4)

***Eric Grossman** surveying the shallow waters of the nearshore by kayak.*

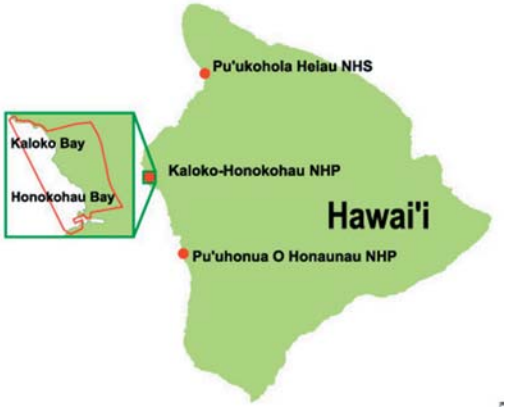
(Hawai'i continued from page 3)

quired SHOALS (Scanning Hydrographic Operational Airborne Lidar Survey) and aerial photography, the georeferenced data from the camera tows and drops will be incorporated into a Geographic Information System (GIS) layer, with the goal of creating a benthic-habitat map for the offshore areas of the park.

Key areas of the offshore terrain include a broad, shallow platform across most of Honokohau Bay in the southern part of Kaloko-Honokohau National Historical Park. Formed by lava locally referred to as pahoehoe, the platform extends seaward to approximately 3-m water depth. Wave exposure is high in this high-energy zone, and freshwater upwelling is prevalent. Small, hardy corals (for example, *Pocillopora meandrina* and *Porites lobata*) are scattered on the pavement throughout the zone. At the seaward edge of the broad platform is an abrupt drop of approximately 5 m to a mixed zone of boulders and pavement with varying coral cover, pinnacles, and canyons. This mixed zone extends across the deeper mouth of Honokohau Bay and northward throughout the entire region of Kaloko Bay, ranging in water depth from 8 to 15 m. The steep seaward edge of the mixed zone is densely covered with mostly live and dead finger coral (*Porites compressa*); it drops off to a gently sloping sandy bottom at 30-m water depth.

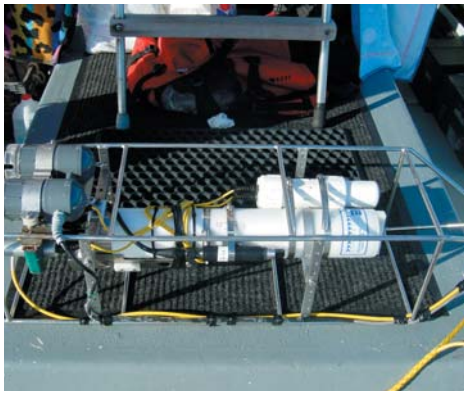
Image showing seaward edge of broad pahoehoe platform.

In addition to collecting underwater video footage, instruments on the camera-towing package also measured the water's conductivity, temperature, and depth, as well as optical backscatter. These measurements were part of a pilot study to identify and quantify submarine ground-water discharge and the flux of associated nutrients and contaminants to the coastal system.



Three parks on the west coast of the Big Island of Hawai'i being studied by USGS scientists in cooperation with the National Park Service. NHP, National Historical park; NHS, National Historic Site.

Future work will include surveys to map the coastal-interface zones of Kaloko-Honokohau National Historical Park, in addition to both coastal and nearshore mapping of the geologic resources of Pu'ukohola Heiau National Historic Site near Kawaihae, and Pu'uhonoua O Honaunau (City of Refuge) National Historical Park.



The towed instrument package includes camera, light, lasers, CTD (conductivity, temperature, depth) sensor, and optical-backscatter sensor.

USGS and Academia in Partnership—Exploring the Use of Joint Fact Finding in Science-Intensive Disputes

By Herman Karl, William Schwab, and Tonya Clayton

For many Americans, the notion of harvesting wind energy comes complete with bucolic images of bright tulips, wooden shoes, and picturesque blades turning lazily in a gentle breeze. For others, the evoked images are less peaceful ones, as modern incarnations of wind farms—actual and proposed—are generating controversy worldwide. One example is a recent proposal to site wind turbines in the waters of coastal New England.

The geographic focus of this controversy is Horseshoe Shoal, an area of shallow water in Nantucket Sound, approximately 5 mi offshore Cape Cod, MA. The 130 wind turbines proposed here for the country's first offshore wind farm repre-

(Partnership continued on page 5)

(Partnership continued from page 4)

sent to some a source of clean, renewable energy. To others, they represent an assault on a precious natural resource. Thrown into the fray are disagreements and controversies regarding aesthetic considerations; international energy policies and politics; potential environmental and economic impacts and benefits; public versus private property rights; implications for tourism, fishing, and other Cape Cod traditions and industries; Federal, State, and local regulatory rights and responsibilities; and so on and on. In short: it's a thorny issue.

One approach to such controversial ecosystem- and resource-management conflicts seeks to replace hostility and conflict among the various factions with a solutions-oriented focus underpinned by a spirit of cooperation and consensus seeking. Joint fact finding, one component of the broader consensus-building approach, is the process by which scientific data and perspectives are brought into the conversation.

Can consensus-building and joint-fact-finding approaches make a positive contribution to complex controversies like the proposed Cape Wind project? This question serves as one focal point of a Massachusetts Institute of Technology (MIT) graduate seminar currently being taught by **Larry Susskind,** Ford Professor of Urban and Environmental Planning at MIT, and **Herman Karl**, U.S. Geological Survey (USGS) Western Geographic Science Center chief scientist and MIT Visiting Lecturer. The goal of this yearlong seminar on "The Use of Joint Fact Finding in Science-Intensive Disputes" is to explore the role of science and scientists in the management of ecosystems and natural resources, with a particular emphasis on joint fact finding as a new approach to policy-making.

Several USGS scientists contributed to the fall 2003 segment of the seminar and to the MIT Environmental Policy Group luncheon-seminar series:

- **Stan Ponce**, Chief of the USGS Office of Partnerships and Business Policy, discussed the role of science in environmental policy with respect to the interior Columbia Basin.
- **Bob Alverts**, USGS Science Advisor to the Western Regional Biologist, and **Christine Turner**, USGS research geologist, discussed the role of science in addressing contentious issues in John Day, OR.
- **Carl Shapiro**, senior advisor to the USGS Director and coordinator of the USGS Science Impact program, talked with faculty about the goal of implementing joint-fact-finding projects.
- **Bill Schwab**, USGS Coastal and Marine Geology Team chief scientist at Woods Hole, MA, **Brad Butman**, USGS oceanographer, and **Brad Barr**, Senior Policy Advisor with the National Oceanic and Atmospheric Administration (NOAA)'s National Marine Sanctuary Program, discussed ecosystems-management aspects of the proposed Cape Wind project.
- **Patrick Leahy**, USGS Associate Director for Geology, presented examples of health- and safety-related USGS research activities and products and discussed the growing importance of joint-fact-finding approaches to framing research questions.
- **Dave Russ**, USGS Eastern Regional Geologist, and two of his senior staff, **Susan Russell-Robinson** and **Jim McNeal**, talked about the role the USGS could play in the Cape Wind controversy and in providing strategic regional-scale baseline data for evaluating the impacts of offshore development.

***Herman Karl** (in white sweater) meets with MIT graduate students and some of the interested parties in the Nantucket wind-farm dispute to discuss the use of joint-fact-finding procedures.*

Other speakers included a representative from a California watershed council experienced in consensus-building approaches, and several senior policy officials from the U.S. Department of the Interior. Collectively, these classroom discussions are helping to develop a process to engage scientists in a joint-fact-finding approach to environmental disputes.

In addition, **Bill** and **Herman** are collaborating to design a multiyear, regional-scale benthic mapping and research project within the context of a joint-fact-finding approach. This work would contribute to a strategic environmental assessment and database to aid in policy decisions addressing offshore renewable energy and such other issues as fisheries management. **Herman's** participation in the MIT course and Woods Hole collaboration are made possible by support from the USGS' Coastal and Marine Geology Program.

USGS Chesapeake Bay Science Meeting

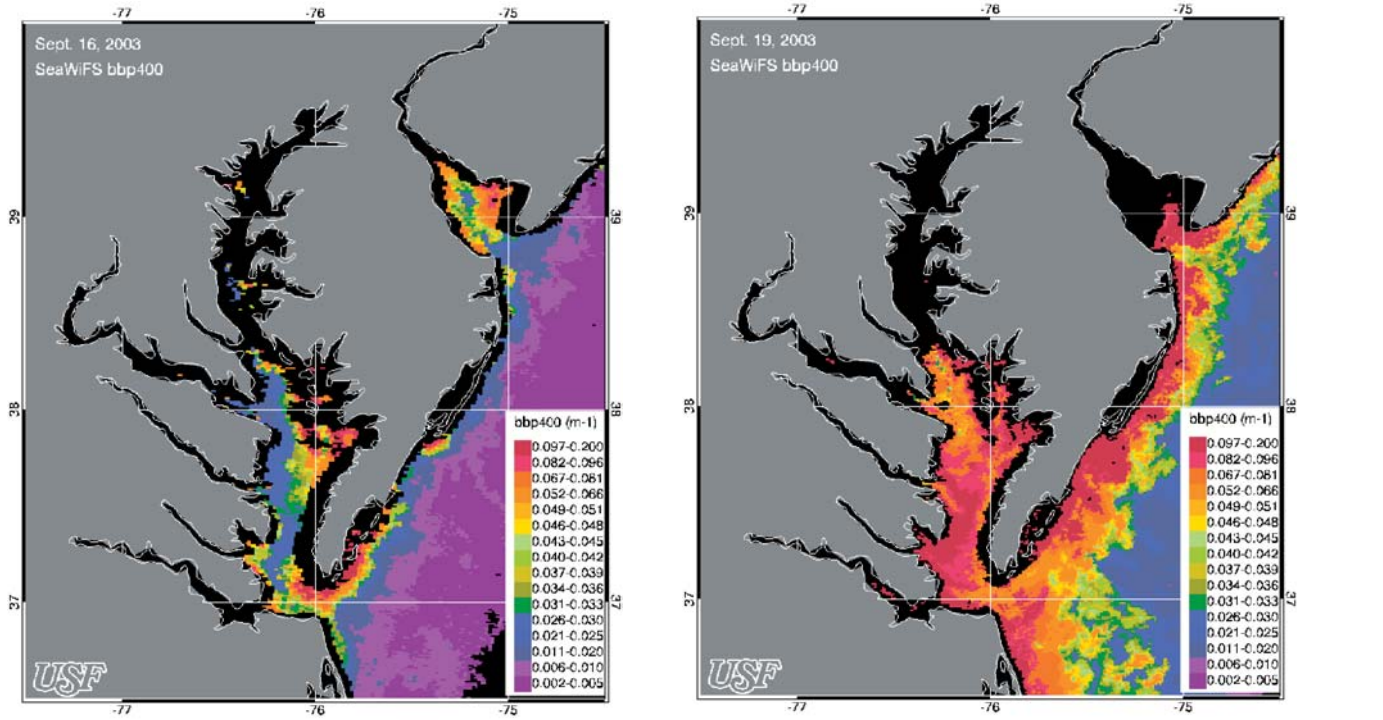
By Tonya Clayton

On November 20 and 21, approximately 80 scientists and science and resource managers gathered in St. Michaels, MD, to attend the biennial U.S. Geological Survey (USGS) Chesapeake Bay Science Meeting. The purpose of this meeting, organized by **Scott Phillips**, USGS Chesapeake Bay Coordinator, was twofold: (1) to provide USGS scientists and managers with information on research needs arising from the "Chesapeake 2000" Chesapeake Bay restoration agreements and efforts (for more information, visit URL **http://www.chesapeakebay.net/c2k.htm**), and (2) to share updates and results from USGS studies addressing those needs.

Session topics included (1) use of USGS science by partners, and future science needs; (2) factors affecting the health of fish, wildlife, and their habitats; (3) data generation, information dissemination, and decision-support systems; (4) sources and impact of sediment on water clarity and biota; and (5) prediction, monitoring, and understanding of nutrient and contaminant delivery to the bay. An evening poster session included approximately 25 presentations covering all five of these major themes.

One result highlighted at the meeting was the recent publication of *A Summary Report of Sediment Processes in Chesapeake Bay and Watershed* (USGS Water-Resources Investigations Report 03-4123), edited by USGS scientists **Michael Langland** and **Thomas Cronin** (to download a copy of the new publication, visit URL **http://www.mgs.md.gov/esic/publications/internet.html)**.

Most of those attending the meeting were affiliated with the USGS, but representatives from the U.S. Environmental Protection Agency and the U.S. Fish and Wildlife Service were also present in the audience and at the speakers' podium. Participants from the USGS' Coastal and Marine Geology Program's field center in St. Petersburg, FL, included **Marci Marot**, **Chuck Holmes**, and **Tonya Clayton**, all of whom are working on topics related to sedimentary processes in the bay. On the basis of their work with short-lived radioisotopes, **Marci** and **Chuck** presented a talk on decadal-scale changes in sediment dynamics in Pocomoke Sound and a poster showing preliminary results of a study of recent sedimentation patterns in Nomini Bay. In collaboration with coauthors **Chuanmin Hu** (University of South Florida) and **John Brock** (USGS), **Tonya** presented a baywide view of Chesapeake Bay from space, before and after Hurricane Isabel. Also in attendance from the Coastal and Marine Geology Program was the Associate Program Coordinator, **Dawn LaVoie**.



Preliminary views of particle-associated optical backscatter in Chesapeake Bay before (left) and after (right) Hurricane Isabel. "Warm" colors (reds and oranges) indicate high concentrations of sediment suspended (floating) in the water column, while "cool" colors (blues and purples) indicate less suspended sediment in the water column. The body of water in the center is Chesapeake Bay; the estuary to the north is Delaware Bay. Atlantic Ocean waters are visible in the lower right corner. Land is shown in gray. Left, Chesapeake Bay 2 days before Hurricane Isabel made landfall on the Outer Banks of North Carolina. Estuary waters typically contain more sediment than do ocean waters. Right, Chesapeake Bay 1 day after landfall; Hurricane Isabel "stirred things up." Both Chesapeake Bay and adjacent continental-shelf waters (lower right corner) contained significantly higher levels of particulates (sediment) than before the hurricane. Original SeaWiFS (satellite ocean color) data courtesy of the NASA SeaWiFS Project and ORBIMAGE. (For more information, visit URLs ***http://seawifs.gsfc.nasa.gov/SEAWIFS.html*** *and* ***http://www.orbimage.com/****.)*

Special Sessions on Gas-Hydrate Systems at Fall 2003 AGU Meeting Showcase USGS Work

By Ginger Barth

Special sessions on "Natural Gas Hydrate from Around the Globe" and "Gas Hydrates in Accretionary Complexes" attracted standing-room-only audiences at the American Geophysical Union (AGU)'s fall meeting in San Francisco, CA, December 8-12, 2003. The sessions were convened by U.S. Geological Survey (USGS) scientists **Ginger Barth** and **David Scholl**, together with their Oregon State University colleagues **Anne Trehu** and **Joel Johnson**, for the purpose of bringing together the diverse group of gas-hydrates researchers within the AGU community. The program included 32 talks and 45 posters in two action-packed days, including 11 USGS presentations by 22 USGS contributors from offices in Menlo Park, CA, Santa Cruz, CA, Denver, CO, and Woods Hole, MA.

Meeting abstracts can be found online at URL **http://www.agu.org/cgi-bin/sessionsfm03?meeting=fm03&sec=OS** (scroll to Thursday and Friday listings: sessions OS42B and OS42C, OS51B and OS51C, and OS52C and OS52D).

Sea-Level Rise Threatens New Orleans and Much of South Louisiana

By S. Jeffress Williams

Experts in the fields of land- and sea-floor-elevation change, sea-level rise, and coastal-land loss addressed concerns about monitoring and measuring Louisiana's vanishing coastal barrier islands and wetlands at a workshop held in New Orleans, LA, December 8-9, 2003. The workshop's primary goal was to formulate and adopt elevation measurements and standards to meet the current and future needs for coastal management and restoration. Participants also discussed methods and measurements of subsidence rates for the coastal zone. The workshop, convened by the White House's Office of Science and Technology Policy and hosted by the Louisiana Governor's Office, was sponsored by the National Oceanic and Atmospheric Administration, the U.S. Army Corps of Engineers, and the U.S. Geological Survey (USGS). USGS Director **Chip Groat** gave a luncheon address on the importance of scientific observations to enable adaptive management strategies; other USGS scientists involved in organizing the workshop or speaking were **Virginia Burkett** (Lafayette, LA), **Don Cahoon** (Laurel, MD), **Charlie Demas** (Baton Rouge, LA), **Mark DeMulder** (Reston, VA), **Bob Morton** (St. Petersburg, FL), and **Jeff Williams** (Woods Hole, MA).

USGS Emeritus Scientist Ed Clifton to Receive the Francis J. Pettijohn Medal for Sedimentology from SEPM

By Mike Field

U.S. Geological Survey (USGS) emeritus scientist **H. Edward Clifton** has been selected by the Society for Sedimentary Geology (SEPM, after former name, Society of Economic Paleontologists and Mineralogists) to receive one of the organization's most prestigious medals. **Ed** is a prominent and internationally acclaimed research scientist who was a leader in science in the USGS' Branch of Pacific Marine Geology (currently the Western Coastal and Marine Geology Team) for more than 2 decades. He served as branch chief from 1978 to 1981 and is currently an emeritus scientist with the team.

Ed will receive the Francis J. Pettijohn Medal for Sedimentology from SEPM this coming spring. The medal is awarded in

(Ed Clifton continued on page 8)

***Ed Clifton** leading yet another unforgettable field trip. This one, for members and friends of the Western Coastal and Marine Geology Team, took place on October 25, 2002, at Point Lobos State Reserve, on the central coast of California in Monterey County. **Ed** holds a Caramello candy bar in front of an outcrop of the Carmelo Formation, which consists of conglomerate and sandstone that accumulated in a submarine canyon during early Tertiary time. **Ed** notes that the Caramello bar consists of chocolate and caramel.*

(Ed Clifton continued from page 7)

recognition of "Excellence in Sedimentology" to persons who have a significant record of outstanding contributions in sedimentary geology, including all aspects of sedimentology and stratigraphy.

The citation reads:

"For trailblazing work in geological and biological aspects of shoreface and nearshore sedimentology; for pioneering work in modern environments and application of the results to the geological record; for leadership in stimulating, organizing, and communicating work in sedimentology; and for leading unforgettable field trips."

The medal will be awarded at the AAPG/SEPM Annual Meeting on April 20, 2004, in Dallas. The award is truly a distinguished and well-deserved recognition for **Ed's** career accomplishments, and we all can bask a little in the honor that it brings to the USGS. He deserves our hearty congratulations!

Ed and his wife **Ann** currently live in Monterey, CA; he can be reached at **eclifton@earthlink.net**.

USGS Book *Beyond the Golden Gate* Wins Outstanding Publication Award

A U.S. Geological Survey (USGS) publication entitled *Beyond the Golden Gate—Oceanography, Geology, Biology, and Environmental Issues in the Gulf of the Farallones* (USGS Circular 1198) recently won a 2003 Outstanding Publication Award from the Association of Earth Science Editors (AESE). Awarded for the first time in 1993, this award is designed to recognize a recently published Earth-science product that demonstrates outstanding editing, design, illustration, writing, and overall effectiveness in achieving its publication goal.

Printed in February 2002, *Beyond the Golden Gate* brings together more than a decade of studies by the USGS and many cooperators in a project led by USGS scientist **Herman Karl**. The Gulf of the Farallones is a complex marine ecosystem adjacent to a major urbanized coastal region (San Francisco Bay). The publication reveals to readers the interconnectedness of geologic, oceanographic, and biological processes in this ecosystem and discusses important environmental issues of contamination and waste disposal.

When this book was released, it drew immediate attention and was featured in both print and broadcast media. The book has also won a USGS Shoemaker Communications Award (see February–March 2003 *Sound Waves*) and a National Association of Government Communicators (NAGC) Blue Pencil Award. It can be viewed online at URL **http://geopubs.wr.usgs.gov/circular/c1198/.**

Santa Barbara *Independent* Names USGS Scientist and Colleague as "Local Heroes" for Western Snowy Plover Protection

By Gloria Maender

The Santa Barbara *Independent* recently recognized U.S. Geological Survey (USGS) scientist **Kevin Lafferty** of the Western Ecological Research Center and **Cristina Sandoval** of the University of California's Natural Reserve System as "Local Heroes 2003." They were honored for successfully providing a 400-yard "nursery" area that enables threatened western snowy plovers to nest undisturbed by human activity on a popular beach at the University of California, Santa Barbara (UCSB)'s Coal Oil Point Reserve. The boundaries of the nursery were designed to minimize inconvenience to beach users, and a volunteer and educational effort was implemented to increase public awareness and interest in the species. Last summer, just 2 years after a simple fence was erected, 39 young western snowy plovers fledged on the Coal Oil Point Reserve beach, signifying the first evidence that a reduction in human disturbance can lead to the recovery of a formerly abandoned snowy plover breeding site. Last fall, the Natural Areas Association also recognized this project by bestowing its 2003 Resource Stewardship Award on the three organizations—the U.S. Geological Survey, the Santa Barbara Audubon Society, and the University of California's Natural Reserve System—whose members are collaborating in the effort (see article in December 2003–January 2004 *Sound Waves*).

MIT Scientists Visit the USGS in Woods Hole, MA

By Chris Polloni

Two scientists from the Massachusetts Institute of Technology (MIT) visited the U.S. Geological Survey (USGS)'s Woods Hole Science Center (WHSC) last November to gather and share information. **Judith Pederson**, Director of the MIT Sea Grant Center for Coastal Resources, and **Christiaan Adams**, an MIT graduate student in the Technology and Policy Program and the Department of Civil and Environmental Engineering, spent November 19, 2003, at the USGS WHSC. One goal of their visit was to get feedback from folks here in the community on how they use and what they need from the MIT Sea Grant Center for Coastal Resources. For more information about the center, visit URL **http://massbay.mit.edu/**.

The other reason for their visit was for **Christiaan** to make a presentation on

(MIT Scientists continued on page 9)

(MIT Scientists continued from page 8)

eSite, a tool for merging scientific and public participation in Marine Protected Area (MPA) site selection. The eSite application was developed to facilitate public participation in and education on environmental-site-selection issues, by allowing users to weight various criteria and see the results within an online mapping system. The case study undertaken involves the hypothetical siting of MPAs within Stellwagen Bank National Marine Sanctuary. **Christiaan** explained the development of the application, demonstrated its operation, and discussed its potential uses. To look at the application, visit URL **http://dogfish.mit.edu/eSite/**. **Christiaan** suggested that this tool could be adapted for other uses—for example, for the siting of energy-generation facilities, such as the windfarm proposed for Nantucket Sound (see related article in Research section, this issue).

Western Coastal and Marine Geology Team Hires Three New Scientists

The U.S. Geological Survey (USGS)'s Western Coastal and Marine Geology Team (WCMG) recently added three new scientists to its permanent staff.

Renee K. Takesue will join the team as a research geochemist, bringing significant expertise in environmental geochemistry, chemical oceanography, and paleoceanography. **Renee** received her B.S. in oceanography (minor in geology) in 1995 from Humboldt State University and her M.A. (1997) and Ph.D. (2002) in chemical oceanography (minors in paleoceanography and atmospheric science) from Columbia University. Her dissertation was titled "Variability in Coastal Upwelling Environments along the Western Americas from Nearshore Geochemical and Paleo-Tracers." In this work, **Renee** used geochemical upwelling tracers in nearshore waters to compare El Niño-related shifts in California Current water properties and hydrography with those in the Peru-Chile Current. She used trace elements in bivalve shells to show that 9,000 years ago, northern California coastal waters were approximately 2°C warmer than today. **Renee** is currently completing a USGS Mendenhall postdoctoral project under **Charlie Bacon** and **Janet Thompson** titled "Research in Environmental Biogeochemistry Using Microbeam Instruments." For this work, she is using the Stanford University-USGS SHRIMP RG (Sensitive High-Resolution Ion Micro Probe Reverse Geometry) to measure trace elements in San Francisco Bay bivalve shells to explore environmental proxy relations, spatial and temporal patterns of trace-metal inputs, and short-term bioaccumulation patterns. **Renee** will be completing her postdoctoral work in March and joining the team in April at the Pacific Science Center in Santa Cruz, CA.

***Renee Takesue** checks her global-positioning-system (GPS) coordinates before leaving to collect surface-water samples off Kaneohe Bay with the Hawai'i Institute of Marine Biology.*

Peter Ruggiero has joined the team as a research geologist, bringing broad expertise in large-scale coastal behavior and evolution, nearshore sedimentary processes, and coastal engineering. **Peter** received a B.S. in civil engineering from Lehigh University, followed by an M.S. and a Ph.D. from Oregon State University. His dissertation was titled "Wave Runup on High-Energy Dissipative Beaches and the Prediction of Coastal Erosion." Following graduate school, **Peter** worked for 5 years as a coastal engineer with the Washington Department of Ecology's Coastal Monitoring and Analysis Program. This work focused on southwestern Washington coastal-erosion studies, a beach-morphology-monitoring program, and the Columbia River littoral cell. **Peter** continued these investigations with the USGS as a Mendenhall Postdoctoral Fellow from 2001 to 2003. **Peter** is also working on several other USGS projects, including the Geological Characterization and Sedimentary Processes of Nearshore Habitats in Kachemak Bay, Alaska (as project chief); National Assessment of Coastal Change Hazards; North Carolina Regional Coastal Erosion Studies; Coastal Evolution, Process-Based Multiscale Modeling; and Coastal Habitats in Puget Sound. **Peter** has also participated in major field experiments at Newport, OR, and Duck, NC. **Peter** will be moving from his present office in Menlo Park, CA, to the Pacific Science Center in Santa Cruz in late spring or early summer.

Peter Ruggiero

Jon Warrick has joined the team as a research geologist, bringing considerable expertise in coastal sedimentology, hydrology, and remote sensing. **Jon** received a

(New Scientists continued on page 10)

(New Scientists continued from page 9)

B.S. in soil science from California Polytechnic State University, San Luis Obispo; an M.S. in civil and environmental engineering from the University of Wisconsin; and a Ph.D. in marine science from the University of California, Santa Barbara (UCSB), where he was a NASA Earth System Science Fellow. His dissertation was titled "Short-Term (1997-2000) and Long-Term (1928-2000) Observations of River Water and Sediment Discharge to the Santa Barbara Channel, California." During breaks in his education, **Jon** worked as a hydrologist and staff engineer for Woodward-Clyde and Komex-H2O Science, Inc. Following his stint at UCSB, **Jon** spent a year on the Earth-sciences faculty at Whittier College, then came to the USGS in 2002 as a Mendenhall Postdoctoral Fellow. **Jon's** postdoctoral work involves development of a research program in coastal sedimentology that focuses on the urbanized margin of southern California. Among other tasks, **Jon** is helping to organize efforts to study hyperpycnal sediment transport and the effects of the recent large southern California wildfires on the marine environment. **Jon** has also been a contributor to the multiagency Bight '03 investigations of water quality and river dispersal in the southern California Bight. **Jon** will be moving from his present office in Menlo Park to the Pacific Science Center in Santa Cruz in late spring or early summer.

We look forward to the contributions of these three new members of our team!❁

***Jon** has a new baby as well as a new job! Here he is with his wife, **Sherie A. L'Heureux**, and their son, **Owen Warrick L'Heureux** (born Jan. 1, 2004).*

Mendenhall Postdoctoral Fellow Joins the USGS in St. Petersburg, FL

By Tonya Clayton

The U.S. Geological Survey (USGS)'s Center for Coastal and Watershed Studies in St. Petersburg, FL, is pleased to welcome **Brian Bossak**, its newest Mendenhall Postdoctoral Fellow. A recent Ph.D. graduate from Florida State University's Department of Geography, **Brian** brings to the center new expertise in hurricane-related research and the development of user-friendly Geographic Information System (GIS) tools for displaying geospatial data. His dissertation, "Early 19th Century U.S. Hurricanes: A GIS Tool and Climate Analysis," includes an examination of the relations between historical U.S. hurricane occurrence and global climate conditions since the beginning of the Industrial Revolution.

Brian Bossak

No stranger to the USGS, **Brian** previously worked for the Water Resources Discipline in Atlanta, GA. Experienced in cartography and graphic design, **Brian** brings to his research the benefits of his previous professional and academic experience with climatologic investigations, photogrammetric and satellite remote-sensing studies of wetlands and land-use/land-cover change, crop assessment via integrated remote-sensing and GIS data analysis, and the application of quantitative methods to geospatial data.

Brian will work primarily with geologist **Bob Morton** and oceanographer **Abby Sallenger** on the quantification of coastal-hazard vulnerability along U.S. coasts. As part of that effort, **Brian** will assist with development of Internet-based digital tools for use by both specialists and the general public interested in examining shoreline change and potential future storm impacts. Stay tuned for research updates from **Brian**!❁

Newly Named Coral Reef Becomes Official for the Florida Keys National Marine Sanctuary

By Barbara Lidz

In 2001, colleagues at the National Oceanic and Atmospheric Administration (NOAA)'s Florida Keys National Marine Sanctuary (FKNMS) and the U.S. Geological Survey (USGS)'s Center for Coastal and Watershed Studies (CCWS) in St. Petersburg, FL, joined in a petition to NOAA to name a coral reef after the late **Captain Roy Gaensslen**, in recognition of his scientific contributions to sanctuary knowledge. In December 2003, **Roger L. Payne**, Executive Secretary of the U.S. Board on Geographic Names, notified **Billy Causey**, Superintendent of the FKNMS, of the board's approval on October 1 to make the name "Captain Roys Reef" official. The decision was made in agreement with the findings and recommendations of the Monroe County Commissioners and the Florida Board on Geographic Names. The name has been entered into the Nation's official geographic-names repository and will appear on all future printings of NOAA charts. The formal entry, which includes the location and a description of the reef, is posted under "Captain Roys Reef" at URL **http://geonames.usgs.gov/**. (Note: Formal geographic names do not include apostrophes.)

(Coral Reef continued on page 11)

(Coral Reef continued from page 10)

From 1974 until his untimely death in 1997, **Captain Roy** was charter-vessel captain for the USGS' Fisher Island Field Station in Miami and for those members who were later transferred to the CCWS. Dedication of the pristine coral reef selected within the sanctuary to honor his memory and placing of a permanent underwater bronze plaque took place on site off north Key Largo in the Florida Keys in July 2001. The ceremony was covered in the August 2001 issue of *Sound Waves* (visit URL **http://soundwaves.usgs.gov/2001/08/staff.html**).

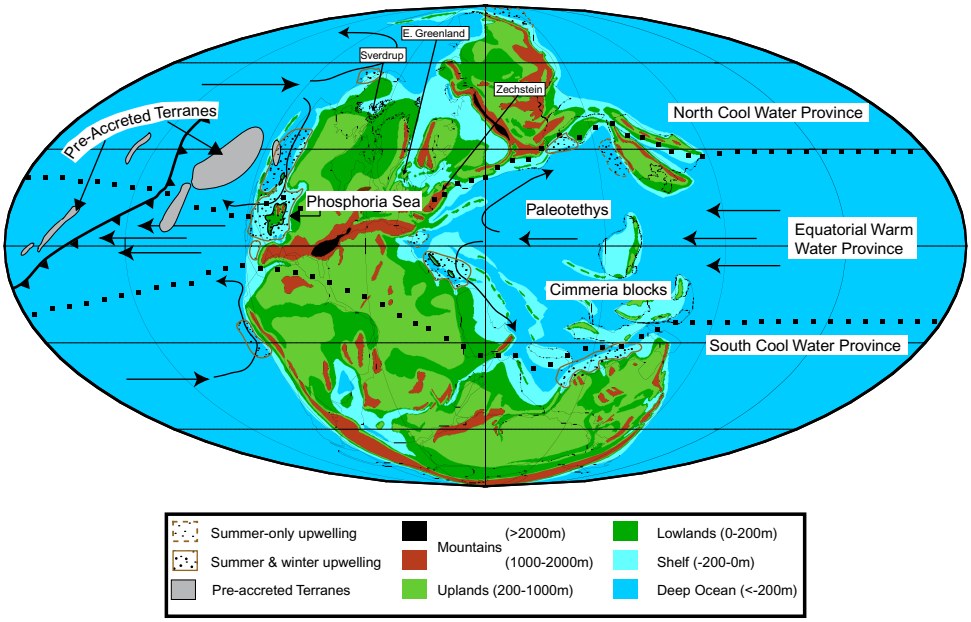
Publications

New Book Edited by a USGS Marine Scientist Examines the *Life Cycle of the Phosphoria Formation*

A newly released book, *Life Cycle of the Phosphoria Formation: From Deposition to the Post-Mining Environment*, is the final product of a large, multidisciplinary project funded by the U.S. Geological Survey (USGS)'s Mineral Resources Program and headed by USGS scientist **James Hein** (Western Coastal and Marine Geology Team, Menlo Park, CA). The project was a collaboration among numerous groups, including the USGS, the Bureau of Land Management, the U.S. Fish and Wildlife Service, the U.S. Forest Service, the Bureau of Indian Affairs, and the Idaho Department of Environmental Quality. More information about the project and a complete list of collaborators are available at URL **http://minerals.usgs.gov/west/projects/phos.shtml**.

Project scientists studied the 350,000-km^2 Western U.S. Phosphate Field, which includes the world's largest phosphate deposit, the Phosphoria Formation. They addressed such issues as the nature of the Phosphoria sea, resource-reserve estimates, the mineralogical-geochemical-tectonic evolution of the deposit, and present-day contaminant issues associated with the release of selenium from waste-rock dumps produced during mining. This last issue involved studies of surface and ground water, soil, biota, and rock. Selenium contamination has killed livestock in the area. Vanadium was also mined from this deposit until 1999, and the deposit was once considered a potential source for uranium.

The 5-year program tied together geology, geochemistry, water resources, and biology into an integrative approach to understand an important U.S. mineral resource—phosphate—and the consequences of its recovery. This type of approach and the knowledge it yields are essential prerequisites for the environmentally sound mining of ores that are critical to the functioning of modern society.



Paleogeographic reconstruction of the Permian Earth and location of the Phosphoria sea (from chapter 1).

Many aspects of this work have direct application to understanding phosphate deposits in the modern marine environment. Although no exact modern analog exists for the depositional setting of the Phosphoria Formation, certain similarities are noticeable in various modern marine environments. The Phosphoria Formation was deposited off the west coast of North America (Pangea) 250 million years ago. The depositional environment was a very wide continental shelf that sloped down to a basin about 200 to 600 m deep. Phosphates were deposited on the shelf, ramp, and basin. Islands to the west (visualize the Southern California Borderland) created a semiclosed basin open to the north and south. Phosphate was derived from organic matter produced during upwelling, but the most important factor for the concentration of phosphate was the lack of dilution by terrigenous and carbonate debris. Terrigenous input was prohibited by low relief and an arid climate to the east, and the formation of marine carbonate was minimized by water temperature and oceanographic conditions.

The Phosphoria Formation is a world-class deposit, and knowledge gained from its study can be applied to many other deposits worldwide. This book will be of interest to environmental geologists and biologists, economic geologists, mineralogists, sedimentologists, oceanographers, geochemists, and others from industry, Federal, State, and local government agencies, and academia.

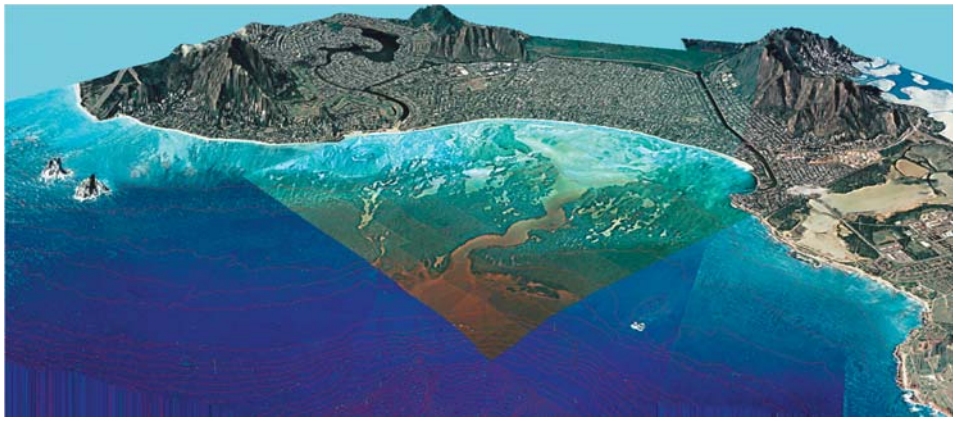
The full reference for the book is Hein, J.R., ed., 2004, Life cycle of the Phosphoria Formation; from deposition to the post-mining environment: Amsterdam, Elsevier, 635 p. [includes CD].

Two Articles by USGS Marine Scientists in the January 2004 Issue of the *Journal of Sedimentary Research*

The January 2004 issue of the *Journal of Sedimentary Research* (v. 74, no. 1) contains two articles by scientists in the U.S. Geological Survey (USGS)'s Coastal and Marine Geology Program.

Dave Rubin's article, entitled "A Simple Autocorrelation Algorithm for Determining Grain Size from Digital Images of Sediment," presents a new technique for grain-size analysis that has several advantages over traditional laboratory techniques: it is 100 times as fast, it is ideal for sampling surficial sediment (the part that interacts with a flow), it can determine vertical profiles in grain size on a scale finer than can be sampled physically, and it can be used in the field to provide almost real-time grain-size analysis. (See related articles in June 2001 and April 2003 *Sound Waves*.)

Eric Grossman's article, entitled "Holocene Reef Development Where Wave Energy Reduces Accommodation Space, Kailua Bay, Windward Oahu, Hawaii, U.S.A.," was coauthored with **Chip Fletcher**, a frequent USGS collaborator at the University of Hawai'i. The authors show that, because of variation in wave exposure, Holocene reef-framework development on Oahu is largely restricted in time (8-5 ka) and space (below wave scour, about 8 to 14 m deep). Little accretion has occurred since sea level stabilized 5 ka. Wave-related impacts (direct wave impact, bottom scour, and sediment abrasion) represent significant stresses that have pushed many reefs to their tolerance threshold. The few modern reefs that do occur on Oahu exist in a narrow window of opportunity squeezed by physical stress related to open-ocean swell and increasing threats due to human activities.



*This image of Kailua Bay appears on the cover of the journal; here is the caption: "The reef (bluish-green tones), reef-top sands (white), and meandering paleochannel (reddish tones) at Kailua Bay, windward margin of Oahu, Hawai'i. Photo is a digital mosaic of multispectral (centered on reef) and aerial-photographic images with 1-m resolution draped on USGS DEM (10-m resolution). Multispectral bands (10 nm) are centered at 488, 551, and 577 nm. **Grossman** and **Fletcher**, this issue, demonstrate that differences in reef-accretion history and development style during Holocene time occurred as a result of differential wave exposure and its interaction with a morphologically complex antecedent substrate. Over 11 m of accretion since ca. 8,000 yr BP suggests that reef growth in Hawai'i is not necessarily limited to wave-protected settings but to settings where accommodation space existed below critical levels of wave-related stress."*

Links to abstracts of the articles are available at URL **http://www.colorado.edu/geolsci/jsedr/Abstracts/jan2004/jsr74-1.html**.

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(Publications Submitted continued on page 15)

(Publications Submitted continued from page 14)

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(Publications Submitted continued on page 16)

(Publications Submitted continued from page 15)

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